NAVAL HEALTH RESEARCH CENTER

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T. Melcer
B. Bohannan
R. Burr
T. Leap
C. Reed
B. Jeschonek

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NAVAL HEALTH RESEARCH CENTER
P. O. BOX 85122
SAN DIEGO, CA 92186-5122

BUREAU OF MEDICINE AND SURGERY (M2)
2300 E ST. NW
WASHINGTON, DC 20372-5300

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Ted Melcer[2]
Britt Bohannan[2]
Ralph Burr[1]
Tom Leap[2]
Cheryl Reed[2]
Bob Jeschonek[2]

[1]Naval Health Research Center
Field Medical Technologies, San Diego, CA
[2]*MTS Technologies, Inc.*

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1.0 Executive Summary

1.1 Background

Recent Department of Defense (DoD) directives call for joint medical surveillance. Joint Vision 2010-2020 states the goals of Information Superiority and Full Spectrum Dominance. In addition, the emphasis on early detection of chemical and biological attacks makes it imperative to conduct rigorous testing and evaluation (T&E) of medical informatics technologies under development to enhance joint force protection.

The Medical Data Surveillance System (MDSS) is a Web-based automated surveillance and data analysis tool intended to integrate medical information for surveillance of deployed forces and patient populations in the United States. The present study evaluated MDSS version 3.1, focusing on its functioning and utility for end users at Navy and Marine Corps MTFs.

1.2 Method

MDSS was installed at Naval Medical Center, San Diego (NMCSD), Naval Hospital Camp Pendleton (NHCP), 121st Evacuation Hospital in Korea, and Naval Hospital Okinawa (NHO). ICD-9 codes from outpatient encounters were used as the primary data source for MDSS.

The T&E plan included 3 phases. The first two phases consisted of administering surveys to medical users at two key junctures: immediately following their initial training on MDSS (n = 20); and following extended use 3 months later, after they had an opportunity to use the product routinely on the job (n = 10). The brief surveys and follow-up interviews measured user satisfaction and utility of the product for their jobs.

The final phase, validation testing, consisted of direct observation of MDSS performance during computer-based tests conducted by independent subject matter experts (SMEs) (n = 3) who executed a representative list of tasks using MDSS. A standard database of real patient encounters was used for data input. This validation test determined whether MDSS performed basic functions as intended by its developers. The T&E team and the developer agreed on a set of administrative, data analysis and surveillance tasks which served to define operationally these intended functions.

1.3 Results

Medical personnel who responded to the posttraining survey were active duty, and most (65%) had positions related to preventive medicine, epidemiology, or environmental health. Respondents provided consistently positive ratings of the MDSS product and the training process.

A subset of these medical personnel responded to an extended use survey about 3 months later. These respondents were active duty, most (6 of 10) with jobs directly related to preventive medicine or environmental health. Half (3 of 6) of these latter respondents used MDSS regularly, at least a few times a week.

Overall, data from all 10 respondents to the extended use survey showed positive ratings of the MDSS features; they favored the data analysis tools and reports particularly for retrospective analyses. However, these ratings were not as consistent and strongly positive as the posttraining data. Respondents agreed that MDSS was better than previous reporting methods, but they were undecided as to whether it helped them to do their jobs. Data input problems prevented regular use and evaluation of the key MDSS feature, the alert matrix. There was no clear example of MDSS as the primary detection tool for disease outbreak.

Validation tests showed that MDSS performed its basic functions as intended by its developers. SMEs raised issues concerning fine-tuning of the system to meet their needs and increase usability. They commented that graphs and reports were valuable, but some report categories were not clinically functional. There was concern that the MDSS alert system produced too many "false alarms."

1.4 Conclusions

The results indicate that MDSS version 3.1 functioned as intended by developers under controlled conditions such as the validation tests and training presentations. However, after extended use at MTFs, users reported reservations about whether the present version of the product helped them to do their jobs. Users still rated the product favorably in general, with some specific ideas about how to fine-tune MDSS. In general, users whose jobs were directly related to disease surveillance and/or preventive medicine favored the concept behind MDSS but did not believe it was ready to use routinely on the job.

Though users were satisfied with data analysis tools and graphics, which are critical investigation capabilities of MDSS, the system's alerting capability was a particular source of concern. A lack of timely and reliable data input to MDSS prevented its key feature, the alert matrix, from being tested. Only one user was satisfied as to the reliability of data input, but reported that the alert matrix produced too many alerts. Thus, further evaluation of this alerting capability will be necessary.

The pattern of data seen from several sources, including validation tests, numerical ratings and comments from posttraining and extended use surveys, supports the validity of the present T&E plan and its measurement instruments. Various suggestions for improvement of the MDSS product for ease of use and utility are listed in the results and conclusions sections of this report. These include designing outbreak alerts based on clinical functional syndrome groups, adding input modules such as pharmacy data, easier access to Excel pivot tables, and development of standard operating procedures for MDSS. Recommended next steps for T&E of this product are presented in the conclusions section of this report.

2.0 Introduction

Although MDSS and associated systems have been evaluated within the Joint Medical Operations-Telemedicine (JMO-T) Advanced Concepts Technology Demonstrations (ACTD) for the objectives of Joint Operations, additional testing is needed to validate consistent performance and assess the system's capability to meet Navy and Marine Corps services specific requirements.[1, 2]

The purpose of the present research was to conduct independent T&E of MDSS version 3.1 during an extended period at First Marine Expeditionary Forces (I MEF) units at Camp Pendleton and to Command and Control (C2) activities at NHCP, NHO, NMCSD, and the 121st Evacuation Hospital in Korea. The present report is a condensed version of a comprehensive final report prepared by the contractor and available upon request.[3]

2.1 Background

MDSS is a promising medical informatics technology approaching maturity. Developed by the Concept Exploration Laboratory (CXL) and Naval Health Research Center (NHRC) in San Diego, MDSS promises to enhance medical support for the Navy and Marine Corps.[1]

The development of MDSS is consistent with the following DoD directives, which identified medical surveillance as important for maintaining force readiness:

- *DoD Directive 6490.2, Joint Medical Surveillance*, 30 August 1997
- *DoD Instruction 6490.3, Implementation and Application of Joint Medical Surveillance for Deployments*, 07 August 1997.

In addition, MDSS addresses the current Joint Vision 2010-2020, which states the goals of Information Superiority and Full Spectrum Dominance. The recent and continuing emphasis on detection and prevention of chemical and biological attacks has made research and development of medical informatics technologies a pressing need for deployed forces.

Previous demonstrations (JMO-T ACTD Cobra Gold '01, Kernel Blitz '01)[2] and discussions among product developers and medical users at sites such as Korea have done much to advance the product. Of all the JMO-T component applications, MDSS received the highest marks for military utility. However, no T&E work by a research group independent of the developer has been conducted emphasizing Navy applications of MDSS. Data collection during previous military exercises and demonstrations was limited to 2 or 3 weeks; therefore, issues of utility or user satisfaction during longer-term use must still be evaluated.

Feedback from users and developer modifications emerging from use at Branch Medical Clinic Chinhae in Korea have led to successive versions of MDSS. The focus of the present evaluation will be MDSS version 3.1.

NHRC command believed that MDSS would benefit from systematic evaluation by a T&E team with its own principal investigator independent of the product development team.[4] Such an evaluation would also allow Navy command a base from which to make decisions on the suitability of the product for future deployment. Thus, the NHRC telemedicine and T&E group, which has previous experience in the evaluation of military medical technologies[5-9], was tasked to develop and execute a T&E plan.

2.2 Objectives

The present evaluation assesses the capability of MDSS to meet the needs of Navy and Marine Corps medical users and validates whether the system functions as intended. Specifically, MDSS was evaluated under the following conditions:

- Long-term use at Navy and Marine Corps settings
- Theatre-type simulation with multiple nodes or sites
- Overseas MTF sites.

2.3 Description of MDSS

MDSS is a Web-based information system that allows real-time medical threat assessment for deployed forces. The software facilitates response to medical threats by providing the preventive medicine officer (PMO), epidemiologist, or Commander-in-Chief (CINC) Surgeon with automated tools to assist in the process of investigating, identifying, and reporting significant medical events.

MDSS automatically searches patient data using ICD-9 codes to provide epidemiologists with tools for early detection of disease outbreaks and chemical attacks. The key feature of MDSS is advanced Dynamic Change-Point Detection (DCD) analysis, which is designed to allow early detection of illness trends and disease outbreaks. MDSS uses a set of dynamic change point and signal detection algorithms to identify the start and end points of medical events, trends, and shifts within routinely collected data. The system is able to identify incidence spikes using relatively small data sets and can calculate baselines using a week's worth of data or less from an MTF. MDSS can also generate standard reports such as Disease and Non-Battle Injury (DNBI) reports.

2.4 Functions to Be Tested

During T&E, medical personnel had interactive access to MDSS with a standard Web browser interface. Through this interface, they were able to perform a variety of analyses and reports.[3]

The following design functions of MDSS were evaluated for user satisfaction and utility of MDSS to enhance medical support for the Navy and Marine Corps:

- Preventive medicine, such as timely surveillance and detection of disease threats
- Analysis of clinical encounters
- Generation of standard reports such as DNBI
- Administrative functions such as controlling access to users and the MTFs a user can view during surveillance.

2.5 Installation Plan

T&E personnel determined that the most practical method for obtaining the data needed for detection of emerging medical threats such as disease outbreaks was to access records of outpatient encounters. Therefore, the data needed for MDSS in a Navy or Marine Corps setting were drawn from real and ongoing patient encounters captured by the SNAP Automated Medical System (SAMS) and for the Ambulatory Data System (ADS) or Composite Health Care System (CHCS) within the Pacific Area Of Responsibility. MDSS version 3.1 was installed at the sites listed above and accessed data directly from these MTFs as available.

The present evaluation assesses MDSS performance at multiple sites to simulate a theatre scenario. Users were able to view and analyze medical data exchanged between several MTFs in a geographic region of operations such as NMCSD and NHCP and their associated clinics.

Conceptually, the deployment of MDSS will result in a system of data collection and analysis that supports the functional goals mentioned (Figure 1).

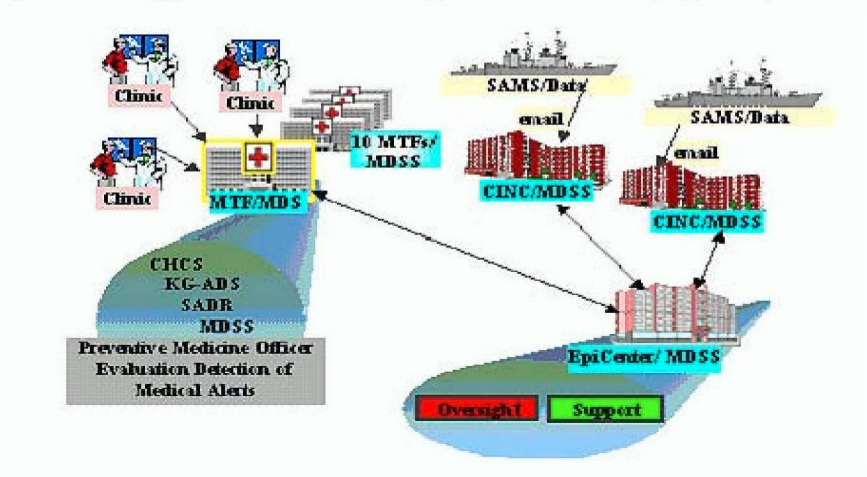


Figure 1. Anticipated Configuration

2.6 Three Phases of MDSS T&E

The evaluation team assessed the reactions of medical users to MDSS at the deployed sites at two key junctures:

- The time of their initial training with the product
- Three months later, when they had used the product routinely on the job for an extended period.

In addition, experts were asked to use MDSS to interpret a test database consisting of real patient encounters to validate whether MDSS functions as intended by product developers.

2.6.1 Posttraining Evaluation

After MDSS was installed and functional at each of the deployed sites, the developers provided formal training which consisted of 2 days of computer-based instruction. The T&E team then administered questionnaires to assess trainees' reactions to the product.

2.6.2 Extended Use MDSS Evaluation

For 3 months after they had been trained, the medical users at each site were asked to use MDSS as a routine part of their jobs. After this period, the T&E team administered a questionnaire to assess the users' reactions to MDSS. The T&E team followed up on responses to this questionnaire with informal individual interviews at NMCSD and NHCP.

2.6.3 Validation Testing

The last phase of the present research consisted of controlled tests of the system's functions. MDSS SMEs were asked to complete a set of tasks representative of important system functions (Appendix C) using retrospective patient data.

3.0 Method

This evaluation tested whether MDSS met design objectives intended by developers. This T&E plan also assessed whether MDSS was an improvement over current methods for medical surveillance. The conceptual factors addressed included system reliability and medical user satisfaction.

The sites for extended use evaluations consisted of Navy hospitals where MDSS and associated technologies were deployed for between 2 and 3 months, with some variation between sites due to logistical problems. Sites included NMCSD, NHCP, NHO and the 121st Evacuation Hospital in Korea.

3.1 Data Sources

Two data sources provided information to meet the T&E objectives:

- Structured interviews with medical users of MDSS
- A validation study of the intended functions of MDSS as agreed on by the developer and the T&E team at the study's onset.

3.2 Structured Interviews With Medical Users of MDSS

Two questionnaires were administered:

- A posttraining survey administered immediately after MDSS training for new users (N = 20) (Appendix A).
- An extended use survey administered approximately 3 months following training, after users had the opportunity to work with the system as a routine part of their jobs (N = 10) (Appendix B).

Individual interviews with medical users were conducted as they were available to follow up on their questionnaire responses. These interviews included assessment of value added to normal business practices.

3.2.1 Development of Structured Interviews

The questionnaires and interview format were based on several sources of information, including:

- MDSS training and user guides
- Preliminary information such as After-Action Reports, surveys and survey approaches provided by JMO-T T&E groups from previous DoD exercises and demonstrations (e.g., Thailand, May 2002)
- Consultations with individuals who participated in the evaluation of these exercises

- Informal interviews with MDSS developers and relevant NHRC personnel, focusing on the desired outcomes of MDSS training procedures and of deploying the system itself

The T&E group used brief, open-ended questions to encourage the relatively few respondents to detail their reactions through written and verbal responses. Multiple choice questions with a limited set of predetermined outcomes might have imposed the researchers' or developers' ideas on users.[10] Each item in the survey also included a 5-point Likert scale of agreement or disagreement.

3.2.2 Posttraining Questionnaire

After each training session, a T&E team member invited trainees to complete a voluntary, confidential survey (Appendix B). On this posttraining questionnaire, users were asked to describe their job functions, reactions to training, and initial reactions to MDSS. Users completed the questionnaires in approximately 10 to 15 minutes and returned the questionnaires directly to T&E team members or returned them by mail. No follow-up interviews were conducted based on the posttraining questionnaire.

Each respondent had the opportunity to write comments after completing the rating scale for each item in the posttraining survey. These comment responses were assigned to categories that emerged from the initial review of all comments in the surveys. Each comment was assigned to only one category. Users could contribute zero, one, or multiple comments for each survey item, and comments for all items across respondents were pooled for this analysis. Every comment was assigned to a category, even if the respondent had made a similar comment in a previous question. The assignment of the comment categories proved to be 100% reliable when two researchers assigned comments to categories independently in both the post-training survey and the extended use survey.

Comment analysis was conducted separately for comments from the posttraining surveys and comments from the extended use surveys.

Comment categories ranged from "ease of use" to "aspects of data reports." "Concerns with data reliability" was a category that appeared in both the posttraining and extended use surveys. The following are examples of comments from this latter category:

- "Though the connection between the data repository and MDSS was established, the inadequacies in collection and reporting of data decreased ability to detect significant increases in disease trends. Data not yet reliable."

- "The data input problem, namely that clinics report only at the end of the month, would affect immediate capabilities of any system like MDSS."

3.2.3 Extended Use Questionnaire

When users had the opportunity to apply MDSS in their jobs for 3 months after training, an extended use questionnaire (Appendix B) was administered. Nine of the ten respondents had attended one of the formal MDSS training sessions. The remaining respondent had had access to MDSS for approximately one year prior to formal training procedures and had learned through self-study and informal discussion with developers.

This voluntary, confidential questionnaire obtained the following information:

- Medical users' backgrounds (e.g., PMO)
- Extent of MDSS use (e.g., daily, weekly)
- How users employed MDSS in their jobs
- User reactions to general and specific design features and functions of MDSS (e.g., medical surveillance, drill-down capabilities)
- Advantages and value added to job performance by MDSS.

The T&E team immediately reviewed each completed questionnaire and scheduled telephone or in-person interviews to follow up on responses to critical items.

3.3 Validation Study of the Intended Functions of MDSS

A validation test was designed to document whether MDSS executed its basic functions. A list of tasks representative of MDSS functions was prepared by the T&E team and agreed on by the product developer (Appendix C). Under controlled conditions, SMEs (N = 3) used MDSS to perform these tasks. The SMEs were experienced medical users of at least two months from two of the MDSS-deployed sites (NMCSD and NHCP) and a third site in San Diego.

3.3.1 Test Procedure

Validation T&E of MDSS was performed in two phases:

1. A test database was assembled based on retrospective patient encounters at NMCSD. The database contained approximately 30,000 patient records from the month of September 2002. The test database and MDSS version 3.1 were installed on a 5.84 GB

Dell Latitude notebook computer. This allowed the tests to be conducted without Internet connection to MDSS online.

2. The tasks were representative of various user roles, such as administrative functions and medical surveillance functions, and were completed in approximately 30 minutes. The SMEs recorded whether or not each task was performed successfully. Success was defined as MDSS's completion of assigned tasks, such as those listed below, without a system crash or substantial delay.

    - Generating reports such as DNBI
    - Detecting trends, patterns, and threats with DCD analysis
    - Correlations of outbreaks to patient units and locations (i.e., drill-down investigation)
    - Selecting a population at risk (PAR)
    - Data analysis features (e.g., pivot tables).

In practice, success was defined by the judgment of SME and T&E observers, who were in agreement on success/failure on all tasks run. Some usability issues were noted by SMEs and were recorded on the task log sheet (Appendix C).

MDSS version 3.1 had previously been tested for accuracy in generating counts for various patient conditions and reports such as the DNBI by contractor.[11] The present authors also conducted informal tests that confirmed that MDSS counts for a given set of patient records matched those counts calculated independently by Excel software for the same set of patient records.

4.0 Results

4.1 Demographics of Trainees

Table 1 summarizes relevant demographics for the 20 trainees. Though duty status and service were not recorded on the survey, informal observations indicated that the trainees were almost all active-duty Navy or Marine Corps personnel. Most (13 of 20) had positions in preventive medicine, epidemiology, or environmental health. Others included a corpsman, a radiation safety specialist and an infection control nurse. Almost two thirds of the trainees (13 of 20) were associated with NHCP, with the remaining 7 individuals associated with NMCSD (n = 3) or NHO (n = 4).

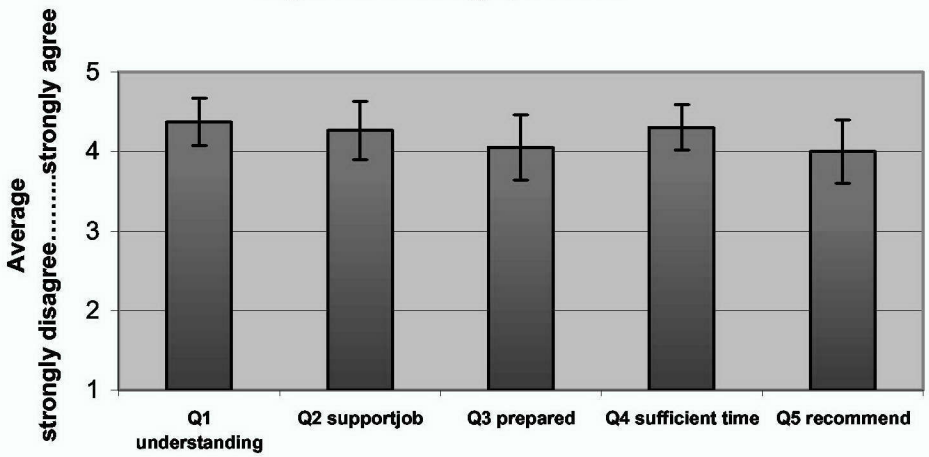
Table 1. Demographics of Respondents to Posttraining Survey

	N	%
Gender		
Male	12	60
Female	8	40
Location		
NH Camp Pendleton	13	65
NMC San Diego	3	15
NH Okinawa	4	20
Position		
Preventive Medicine	7	35
Corpsman	2	15
Environmental Health Officer	4	20
Epidemiologist	2	10
Other	5	20

4.1.1 Numerical Ratings by Trainees

Figure 2 shows that respondents provided consistently positive mean (+/- ½ standard deviation) ratings of the MDSS product and the training process. Scores closer to 5 indicated more agreement with each statement. The mean ratings for all 5 questions were at least 4.0, indicating agreement with the statements in the survey such as "I am prepared to use MDSS," and "I would recommend MDSS to my command."

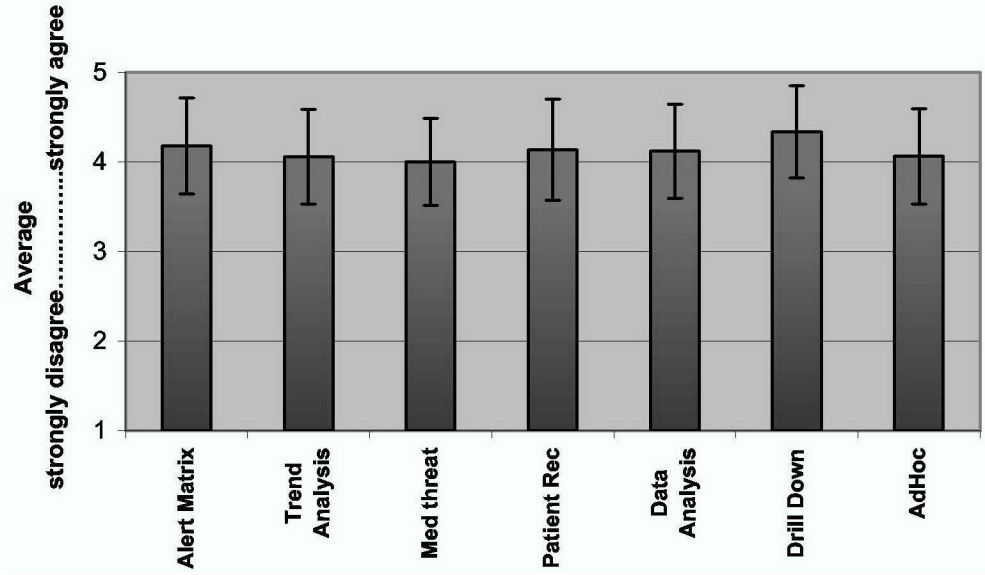
Figure 2. Training Questions



4.1.2 Usefulness Ratings of MDSS Features

Figure 3 shows that respondents provided consistently positive ratings of MDSS features such as the alert matrix and drill-down capabilities when asked to judge their usefulness based on the training presentation they had just completed. The mean (+/- ½ standard deviation) ratings for all 7 features listed were at least 4.0 on the rating scale, indicating that the respondents judged them to be useful.

Figure 3. Usefulness Ratings



4.1.3 User Comments on Survey Questions

Figure 4 shows the percentage of all comments (N = 47) for various categories of information. All 20 respondents contributed at least one comment. The most prevalent comment was that MDSS was a good system (25%). With regard to the training process, respondents often commented that they would have to use the system more (21%) and that the training was well run (17%). Informal observations often indicated that users were anxious to test the system capabilities based on the potential that they had seen during training.

Relatively few negative comments were made about unorganized training (11%) and concerns about data quality, data sources, and relevance to the respondent's command. The T&E team's specific recommendations to address training improvements were presented above.

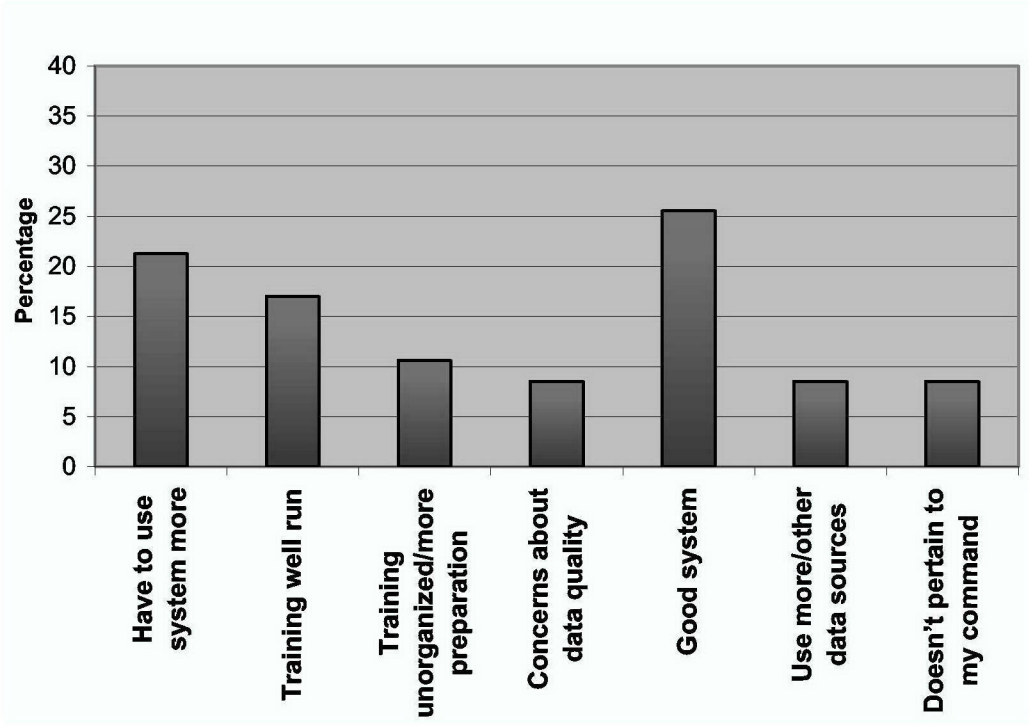


Figure 4. Comment Categories

4.2 Extended Use Survey Data

4.2.1 Demographics

Ten individuals responded to the extended use survey. Nine of the respondents were tracked from their attendance at MDSS introductory training sessions. There was one exception, a long-term user overseas

who learned MDSS prior to the initiation of the formal MDSS training sessions.

Table 2 shows that these individuals were mostly active-duty Navy personnel, primarily males from the San Diego or Camp Pendleton sites. Most respondents had job positions relating to preventive medicine or environmental health. They also noted training in epidemiology and preventive medicine, with substantial experience and duties related to disease surveillance.

Table 2. Demographics of Respondents to Extended Use Survey

	N	%
Gender		
Male	9	90
Female	1	10
Duty Status		
Active	10	100
Other (civilian, retired)	0	0
Service		
Navy	9	90
Army	1	10
Location		
121st Korea	1	10
NH Camp Pendleton	6	60
NMC San Diego	2	20
Branch Medical Clinic Barstow	1	10
Position		
Preventive Medicine Officer	3	30
Corpsman	4	40
Environmental Health Officer	3	30

4.2.2 MDSS Usage Frequency

The respondents reported how frequently they used the system and described the nature of their usage. All individuals had formal or informal introductions and training in MDSS. Almost all had at least intermittent access to the Web-based application during the 2- to 3-month study period.

As seen in Figure 5 (n = 10), 7 of the respondents (70%) used MDSS infrequently; they said that they rarely used MDSS or used it a few times a month. Most of these individuals did not have positions directly related to surveillance (i.e., 4 of these 7 respondents were corpsmen). Informal feedback from respondents and developers confirmed that MDSS connections to MTFs were more reliable than connections to outlying clinics where these corpsmen worked.

The remaining 3 individuals reported using MDSS regularly, a few times a week or daily. These 3 individuals worked in positions directly related to surveillance, with training in preventive medicine and/or epidemiology. These respondents worked at MTFs, 2 in the United States and 1 overseas, where MDSS had been operational for over a year.

In summary, 4 respondents were corpsmen, and MDSS was not very relevant for their jobs. MDSS was most relevant for the jobs of 6 of the respondents in this extended use survey sample. Fifty percent of these 6 individuals (3 of 6) reported using MDSS regularly in their jobs during the study period.

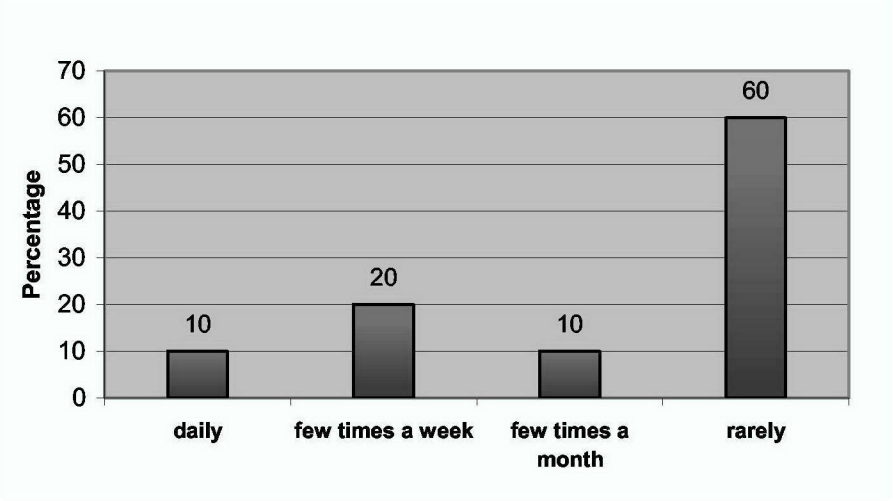


Figure 5. How Often MDSS Presently Used

4.2.3 Numerical Ratings for Usefulness and Satisfaction

After questions relating to demographics and frequency of use of MDSS, the remaining questions in the extended use survey focused on measuring user reactions to the use of MDSS, including numerical ratings and coding of written comments.

Figure 6 summarizes mean ratings (and range of scores, e.g., 4-5) for questions about the utility of MDSS information. Overall, users provided consistently favorable ratings of MDSS for its medical threat information and usability. The mean and median scores (medians not shown) for 11 of

12 questions were on the upper end of the 5-point scale, indicating positive reactions to the MDSS product (e.g., MDSS provided useful information; MDSS was easy to navigate; MDSS information was presented in a useful format). Scores closer to 5.0 indicated more agreement with the survey statements. The extended use survey is attached in Appendix B for reference. Samples sizes across survey items varied between 3 and 6 respondents because not all survey items were relevant for all respondents (e.g., respondents marked "not observed").

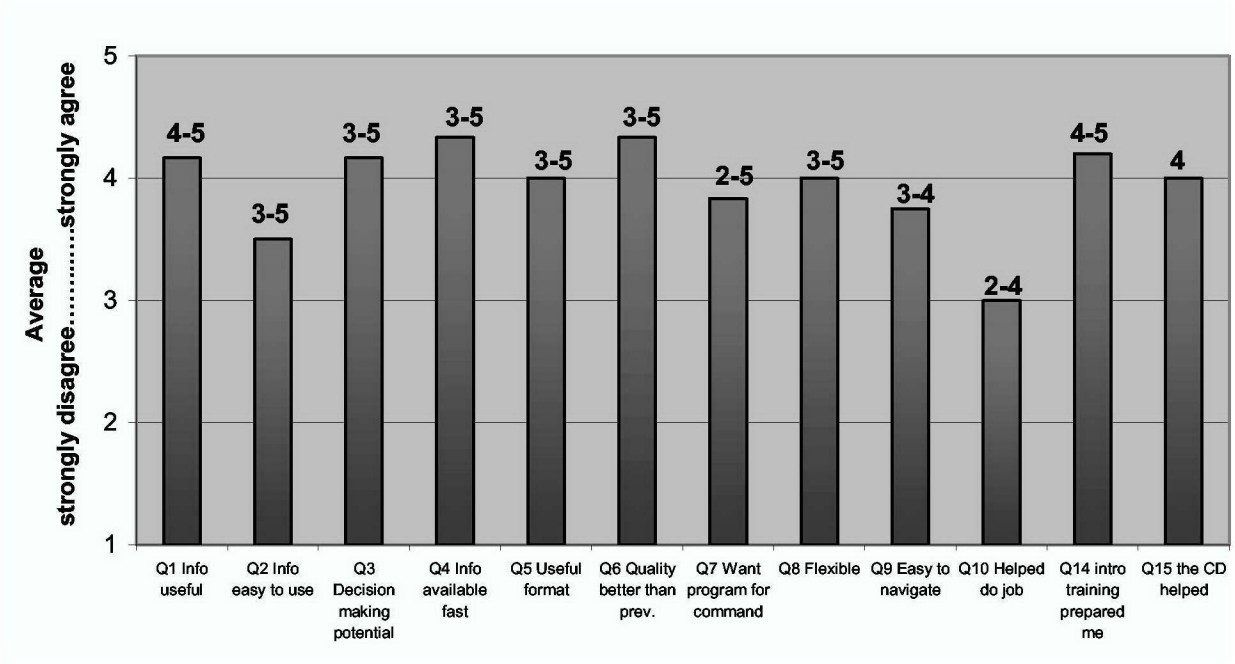


Figure 6. Questions (Range of scores shown above each bar)

The figure shows variability between questions in the average ratings. Several critical questions deserve emphasis here:

- Users were asked if the quality of MDSS medical threat information was better than that supplied by previous reporting methods (Q #6). This question received the most favorable rating (mean = 4.3, or between strongly agree and agree).
- Users were asked if MDSS was easy to use (Q #2). This question received a relatively low rating (mean score = 3.5, or between agree and undecided).
- When asked if MDSS helped them to do their jobs, the users were undecided, neither agreeing nor disagreeing with the statement (average = 3.0). This question received the lowest rating of all the questions.
- Finally, users agreed that the introductory training and CD reference guide (provided several months before the training) were helpful introductions to MDSS.

Because of small sample sizes, it is difficult to draw statistically reliable conclusions from comparing individual questions. These contrasts will be considered later in the discussion with other information – such as ratings

of individual features, user comments and validation tests – to determine if a consistent pattern of results emerges.

4.2.4 Numerical Ratings for MDSS Features

Figure 7 summarizes mean (and range of scores, e.g., 1-5) user ratings for satisfaction with specific MDSS capabilities, such as alert matrix, reports, and DCD capabilities. The mean and median ratings (medians not shown) indicated that users were satisfied or very satisfied with most of the features, such as DNBI reports, DCD, drill-down capability, reduced staff calendar, and graphics. Some comments include: "Easy to compare current data to old [data]" (referring to DCD), and "Those graphs are really easy to look at a glance."

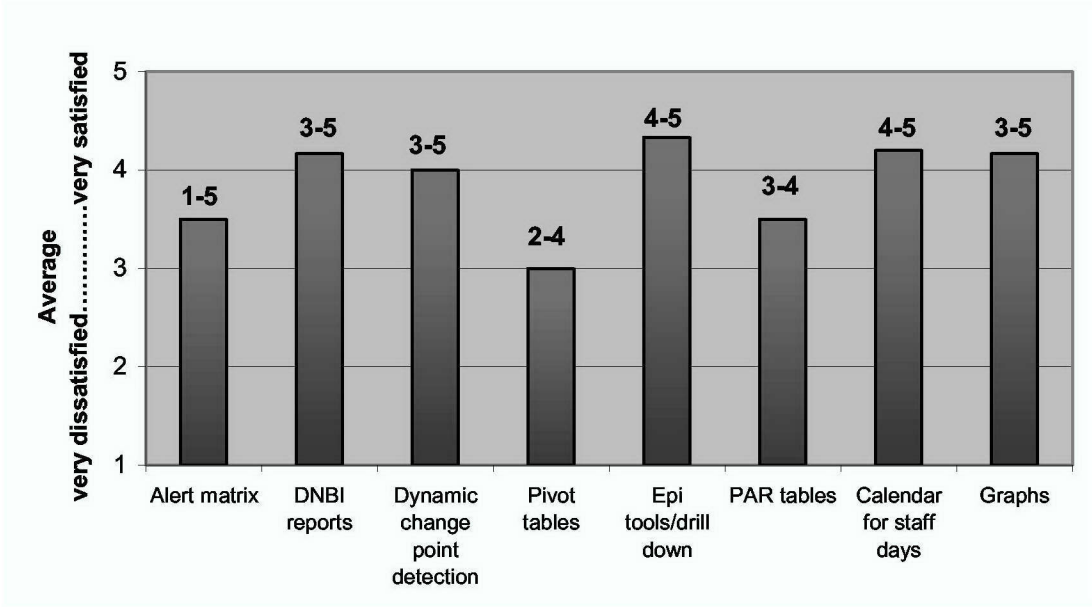


Figure 7. Satisfaction with Functions (Range of scores show above each bar)

Several remaining features received slightly less favorable ratings between undecided and satisfied, such as the alert matrix, pivot tables and PAR tables. One comment given about the PAR tables was that they "require data input on my part but unit level info is difficult to acquire and maintain." A comment about the alert matrix stated that it was "not updated in real time," meaning that there is a lag of approximately 1day before data input to the system. (It should be noted that the alert matrix was dependent on timely data input, so the updating issue is not an MDSS design issue.)

4.2.5 User Comments

Figure 8 summarizes the percentage of all comments (N = 40) for various categories of information. Five respondents provided one or more comments. For this analysis, user comments for all questions were pooled and coded into exclusive categories.

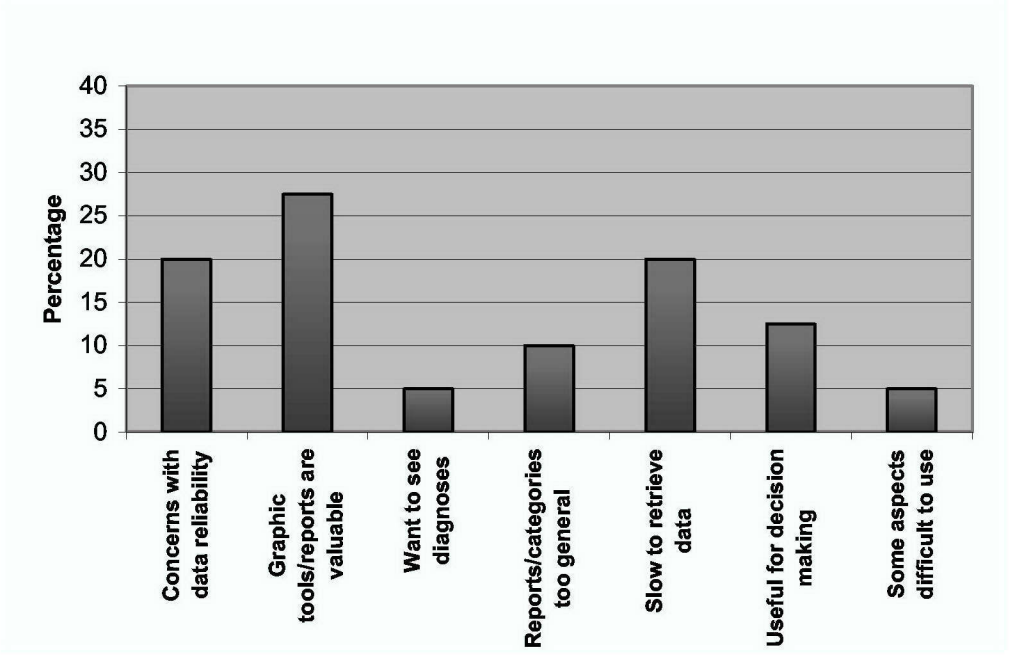


Figure 8. Comment Categories

Several results are apparent. First, there were more negative comments (60%, coming from 4 respondents) than positive comments (N = 40%, coming from 4 respondents). The positive comments mostly reflected user satisfaction with the graphics and report-generating capabilities of MDSS. The negative comments mostly reflected data input problems, which were not due to an MDSS design issue and could have resulted from network overloading or slow connections. Negative comments also suggest that users believed that reports were too general in nature; users also seemed to want to see diagnoses/complaints more directly accessible as an MDSS analytical capability.

4.3 Additional User Responses

MDSS users offered other noteworthy responses in the extended use survey, including opinions on the most useful feature, the least useful feature, and the most preferred addition to MDSS.

4.3.1 Most Useful Feature

Users were asked what was the most useful feature of MDSS for their jobs. Four users offered the following responses:

- Well-organized data
- DNBI index
- It is pretty quick since CHCS is updated daily
- Reports, enhances surveillance capability for individual clinics separately.

4.3.2 Least Useful Feature

Users were asked what was the least useful feature of MDSS for their jobs. Three users offered the following responses:

- Lack of data
- Dependent on CHCS input
- Some ICD-9 codes are off base, causing the alert system to sound off.

4.3.3 Most Preferred Addition

Users were asked what one thing they would want to add to MDSS. Four users offered the following responses:

- A statistical graph based on a local map
- Trend analysis
- Provide e-mail alert to notify about abnormal alerts
- ER application and pharmacy data
- Top ten ICD-9 codes.

5.0 Validation Study Results

The primary purpose of implementing a validation study is to confirm that the system works as intended. The intended functions were defined by a set of tasks representative of important system functions (Appendix C) using a known set of retrospective outpatient data.

5.1 Subject Matter Experts

All participating SMEs were active-duty Navy officers. One was a PMO with primary training in epidemiology. He rarely uses MDSS but has given

demonstrations of MDSS in the past, including a demonstration at Kernel Blitz in 2001. This user had daily on-the-job experience with a similar system, ESSENCE, for surveillance.

Another SME was an EHO trained in epidemiology. Primarily, he uses MDSS retrospectively to send reports to other clinics. His main interest is in surveillance. Though he says that he does not mind tracking down alerts, he says it is just a matter of having enough time to do it.

The third SME is also an epidemiologist and uses ESSENCE every day. He states that until now, he could not use MDSS, but now that there is a dedicated server for it, he will most likely use it often.

5.2 MDSS Performance

In terms of overall performance with reference to the Validation Task List, Version 1, July 31, 2002, MDSS displayed the following as intended by developers:

- Trends in the data, through graphs, individual patient data, and tables
- Alerts of disease threats
- Alerts of potential chemical/biological attacks
- Report generation (e.g., DNBI, Chemical Biological Radiological [CBR], Reportable Conditions, Ill-Defined Conditions, Key Symptoms)
- Location of outbreaks
- Date of patient visit
- Onset and offset of disease trends and outbreaks.

The three 30-45 minute validation exercises performed support this conclusion.

5.3 Validation Tasks

The various tasks completed during the validation study were representative of various user roles, such as administrative functions (e.g., assigning reduced staff days), medical surveillance functions (e.g., viewing background alerts, running DNBI reports) and nonmedical user roles (e.g., viewing weekly incidence rates). (See Appendix C)

The validation exercise included 35 tasks: 10 tasks under the administrative function, 19 surveillance role tasks, and 6 nonmedical role tasks. Not all SMEs completed all tasks in the interest of time.

5.3.1 Administrative Tasks

Two SMEs completed 10 of 10 administrative tasks successfully, whereas one SME skipped this first section because of time restrictions and the fact that he would not be using MDSS administrative functions.

5.3.2 Surveillance Tasks

The surveillance role was the longest section, and all 3 SMEs participated. (One SME, in the interest of time, did not complete all of the tasks.) Most of the testing effort was concentrated in this section because it was the most relevant for the SMEs.

One SME tested 15 tasks, and all 15 were successfully completed. One tested 16 tasks and completed all 16 successfully, and one tested 7 tasks and completed all 7 successfully. The reason that SMEs were asked to test only a subset of the 19 possible tasks was to shorten the session to accommodate the SMEs' schedules. In most cases, the tasks that were intentionally omitted were somewhat redundant with previous tasks.

In one case, 2 SMEs did not specify which MTF they wanted to look at when running a background alert, and MDSS successfully alerted them before they could proceed. During testing, several issues and concerns were raised by the SMEs, such as whether rates or counts were supposed to be displayed, all of which are addressed in the next section.

Two SMEs agreed that MDSS helped or would help them in their jobs, though a third considered it too sensitive. This user indicated that if modifications were made in the ICD-9 grouping, or users were enabled to break out bioterrorism (BT) reports/alerts, he would be motivated to use MDSS more frequently. (Regarding the request for BT reports, the authors of this evaluation believe that further training with MDSS, and its CBR reports in particular, could make the system more helpful for this and other users.)

In summary, these validation tests showed that under ideal conditions (e.g., no network issues or running reports with too much data), MDSS functioned as intended.

5.3.3 Nonmedical Tasks

Only one SME participated in the nonmedical user role, because the tasks assigned to that role did not pertain directly to the SMEs' jobs. The individual who did participate in the nonmedical role section skipped two relatively redundant tasks (because he had completed similar tasks in the surveillance section), but completed 3 of the remaining 4 tasks successfully. One task (Reportable Conditions Summary Report

generation) was flagged for review when it appeared that the display was unintentionally showing the entire month when a week was specified. It was later determined to be functioning as intended by developers, and all 4 tasks were considered to completed successfully. This issue is addressed below in the Issues and Solutions section.

5.4 Issues and Solutions

Numerous issues arose during the validation study of MDSS. In some cases, solutions were proposed to address these issues.

5.4.1 Surveillance Analysis Functions

The validation study led to a question regarding the surveillance analysis functions. Using PAR values, the surveillance analysis functions calculated daily and monthly incidence rates as intended, but the weekly incidence rates did not appear to be calculated correctly. This discrepancy was determined by the developers and confirmed by the T&E team to be due to a missing PAR value; since the PAR value was not entered, the rates were not being calculated.

5.4.2 False Alarms

Two SMEs voiced concern that MDSS was too sensitive, that there were too many false alarms. The literature explains, and the developers agree, that in using surveillance systems, you need to know what you are looking for to understand if you should investigate an alert.[12] The third SME agreed with this perspective and gave a hypothetical scenario: if you are looking at a place with a very small population, you need to know that it is a very small population because small numbers will cause an alert. This user explained that he would prefer to see false alarms that he could check and use as a guide, rather than not seeing the alert at all. A similar approach was advocated in the development of decision rules for screening for possible tuberculosis cases using automated health data.[13]

5.4.3 Reliability of Data Input

One SME was concerned about the reliability of data input from SAMS or CHCS matching MDSS requirements. He noted that many clinics collect and report surveillance data as aggregate or group data without individual records or identifiers. The SME wondered whether MDSS should be able to input these kinds of aggregate or group data, as they are used routinely by clinics and reported as group data to higher levels of medical command.

5.4.4 Lack of Biochemical Terrorism Reports

A concern arose over the lack of reports targeted specifically to biochemical terrorism outbreaks. The developers explained that CBR reports cover those kinds of alerts, and if an outbreak were to occur, it would be displayed in CBR reports. This was noted, and the CBR reports were run to verify that biochemical alerts are in fact displayed within the CBR category. When this was verified, it was concluded that the user who raised the concern had not fully understood the CBR function. Further training in this area may serve to alleviate the user's concern. Where possible, mechanisms should be developed to support ongoing interaction between user and developer.

5.4.5 Alert Grouping

An SME expressed concern that the alerts are not grouped by syndrome and therefore might not be effective in determining a serious outbreak. The developers clarified that a serious outbreak would be easily detectable because the Symptoms or Ill-Defined Conditions reports would specify it. The developers also pointed out that within the Key Symptoms alerts, the larger counts in each symptom grouping are listed in order of frequency and group together at the top of the report, enabling clinically functional syndromes to be determined. Another SME agreed with this conclusion. The scenario was recreated to verify this conclusion, and it was found that in running DNBI reports and Key Symptoms alerts, the outbreaks that occurred were grouped together by occurrence of symptom. Viewing these two reports together, a user could determine the syndrome that was occurring. This sort of nuance in MDSS usage would be another issue worth emphasizing during training and ongoing interaction with users on the job.

5.4.6 Rate per Thousand

There was a question whether the rate per thousand was a rate or a count. It appeared to be a count and was displaying as a count because the PAR number had not been entered.

5.4.7 Links to Windows

In one validation exercise, the weekly CBR report was observed to have the outpatient counts and weekly incident rates linked to different windows. However, the weekly rate per thousand linked to the same window as the weekly incident rates. An SME questioned whether these rates should link to the same window, namely the graph display. It was determined not to be a fault in the software, which functioned as intended by developers. The outpatient information is a direct means to view a list

of individual patient information. In contrast, the incident and rate per thousand link to windows that display graphs, with the individual patient information available in an Excel file.

5.5 Useful Functions

The validation tests also provided insight into what functions of MDSS were considered especially useful. These include:

- DNBI reports, which allow for double-checking against other sources for number of cases and to identify reports that are not coming from other sources.
- Dynamic Change-Point Detection was considered by one SME to be the most useful MDSS tool.
- Reduced staff days and the ability to enter them.
- Having both counts and rates displayed is useful.
- User-specified analysis/control: time period, key symptoms.

6.0 Recommendations

Based on the validation tests, surveys and interviews, several recommendations for the development of MDSS can be offered.

6.1 Excel/Pivot Tables

During training observations, 2 SMEs and some trainees considered it cumbersome to move data into Excel and use pivot tables. This fact supports the conclusion that this function should be modified or users trained differently. To use this function successfully, users are expected to be proficient in Microsoft Excel, although this might not be the case. It is possible to further simplify these features by adding an Excel macro or a graphical user interface for the pivot table functions.

6.2 Additional Data Modules

It might be beneficial to investigate adding one or more modules to MDSS. The developers of ESSENCE are considering expanding their system by adding pharmaceutical, laboratory and radiological exam data from all MTFs currently capturing this information. Accessing these data might provide a separate but complimentary and confirmatory model to the system.[10] Such additional data would also help to detect diseases that occur in extremely low numbers, such as West Nile Virus cases or the few anthrax cases that occurred through the U.S. Postal system in October 2002.

6.3 ICD-9 Coding

Although MDSS is a tool and should not be substituted for human interfacing and decision making, certain techniques could reduce the risk of questionable data quality. One such technique is the grouping together of ICD-9 codes by their clinical utility. This might decrease the impact of variation in ICD-9 coding practices.[13] Coding variations were a concern among the SMEs, as well as users. Currently, for example, many strep patient diagnoses go to Ill-Defined Conditions rather than respiratory, and this might decrease or obscure the detection of an outbreak. Using broad syndromes should assist in trend detection.

7.0 Conclusions and Recommendations

This study consisted of the T&E of MDSS version 3.1, a Web-based semi-automated disease surveillance system intended for Navy and Marine Corps applications. Survey data gathered after training presentations and extended use at MTFs and observations during controlled validation tests indicated that: 1) the product functioned as intended by developers, 2) users found some features of the product useful for their jobs but overall they were not convinced it was ready to use on a routine basis and, 3) modifications to the product may enhance its utility for surveillance work. A summary of evidence supporting these three conclusions is presented below.

First, the data from the validation tests demonstrated that MDSS functioned as intended by developers. Independent SMEs were able to execute a representative set of functions successfully without significant failures. It was not within the scope of the present T&E to evaluate the statistical algorithms that MDSS uses to generate alerts for disease outbreaks and trends. The MDSS algorithms have been patented and have undergone scientific review as part of the patent process. The developers are encouraged to present the data supporting their choice of algorithms at professional conferences and in articles submitted to peer-reviewed journals.

Second, several types of information from the extended use survey indicated that users were strongly in favor of the concept behind MDSS but did not believe that it was ready for routine use. Users agreed that the quality of MDSS information was better than that supplied by previous reporting methods, but overall, they were undecided as to whether it helped them do their jobs (questions 6 and 10, Figure 6). Users also reported relatively weak but positive ratings when asked if MDSS was easy to use and navigate (questions 2 and 9, Figure 6). The extended use ratings were not as strongly positive as those provided immediately following training. The results suggest that when MDSS was operated in a training environment with the developer present in a planned demonstration, the product received higher ratings than when users based their ratings on usage in a real-world work environment. For instance, Figures 3 and 7 show respondents' ratings of MDSS features such as the alert matrix after training and after extended use, respectively. Responses to the extended use survey show variability across features and lower ratings for the alert matrix in particular.

User comments also differed after training and extended use. The most prevalent posttraining comments by users were that MDSS was a "good system" and that the users would "have to use the system more," suggesting that it was appealing for them to learn. In contrast, after extended use, respondents commented mostly on a specific positive aspect, such as the "valuable graphics tools and reports." They also isolated concerns about data input problems and the design of the system ("difficult to use", "want to see diagnoses"; Figures 4 and 8).

The key feature of MDSS is real-time automated surveillance, augmented by user-controlled "drill-down" or epidemiological tools to investigate disease trends. None of the users appeared to integrate the automated surveillance feature into their work routinely, mostly because of problems with data input to MDSS. However, users did

make extensive use of data analysis features retrospectively for job reporting requirements and disease tracking from month to month. Analysis of the extended use comments was consistent with the findings from the numerical ratings. The most prevalent comment was that the graphics tools and reports were valuable, followed by negative comments on data input problems (Figure 8).

One regular user did comment that the MDSS tool was the first source to detect several tuberculosis cases prior to other usual sources. This is the only evidence of primary detection of important disease occurrences noted in this study. However, the same user also reported that MDSS did not aid in the detection of a local outbreak of Strep A at MCRD San Diego. The alert matrix for this user had not been functional due to data input problems, limiting its utility for this outbreak. The user went on to speculate that MDSS would have provided alert of this outbreak no sooner or later than current methods of reporting, namely telephone calls from the affected clinics.

Third, a number of modifications were recommended to improve product utility or usability. See also sections 5.4 and 6.0 in this report on Issues, Solutions and Recommendations:

- A standard operating procedure for MDSS could be developed through discussion with current users and presented during training. This could include the personnel and time necessary to allow optimal usage of the system. Several primary users commented that substantial person power is required to fully utilize and evaluate MDSS.
- Alerts might be most effective when triggered by clinically functional syndrome groups rather than traditional reporting, such as DNBI or Major ICD-9 groupings. The Key Symptoms groupings appear to be a strong step in this direction. Research to validate the utility of the groupings would be essential.[12]
- ICD-9 groupings were not functional because they are too general as currently generated.[12, 13] A more specific list of top 10 ICD-9 codes may be more useful for surveillance and reporting purposes. This is related to the above point. In future versions, developers should carefully refine special groupings like this and conduct an evaluation of their utility.
- Though the training sessions were well received, follow-up sessions should be conducted where possible on important features. Such a feedback mechanism would allow developers to take proactive steps to intervene and reinforce important features, especially to relatively new users. During the present study, evidence indicated that users requested features that were already in place in some form, such as Key Symptoms and CBR reports for biochemical terror threats.
- Ultimately, other data inputs to MDSS, such as pharmacy and ER data, might be valuable for comprehensive surveillance.[12]
- A geographical mapping function to show the distribution of locations of disease trends and outbreaks could be useful.[14]

Finally, As MDSS and other Web-based applications for disease surveillance mature, a substantial number of research reports on these technologies will begin to appear in the literature.[12-16] Therefore, it will become essential to provide current critical review of the literature to optimize the development and evaluation of these products.

8.0 Study Strengths and Limitations

This section reviews the strengths and limits of the present study design and its measurement instruments.

8.1 Converging Evidence

The primary strength of the present T&E design comes from the ability to evaluate the MDSS product based on converging evidence from several sources. Users completed surveys after training and again several months later, after they had had an opportunity to use MDSS as a routine part of their jobs. The T&E team also followed up on responses to the extended use surveys to interview primary users. Thus, data included both numerical ratings of usability and satisfaction and comments by users. A third source of evidence came from the controlled validation tests of specific MDSS functions.

8.2 Scientific Validity of Surveys

The present results are primarily descriptive because of limited sample sizes available and therefore trends from a small number of individuals are emphasized. However, it is worth noting that with relatively few respondents, each individual was tracked more carefully and they appeared more motivated to fill out the survey. The extra time taken by many respondents to write comments also is consistent with their careful attention to the survey task.

Samples sizes were too small to test reliability and validity of the current surveys but the general pattern of results was reasonable. For instance, survey ratings of product performance were most favorable under controlled conditions during training and validation testing. These ratings were less favorable when the product was installed at MTFs for routine use with ICD-9 data input problems and a busy working environment.

8.3 Study Limitations

As mentioned, the main limitation of this study was small sample sizes. Three users tested this product regularly on the job for 2 to 3 months and therefore had extensive opportunity to use the product and were able to provide reasonable and systematic survey responses. However, it is not clear how the results from these individuals will generalize to other users. Some respondents were corpsmen and reported not using MDSS regularly. This could be because of inexperience with

surveillance and epidemiology, or because their jobs did not require surveillance, or because they were located at clinics that had problems with access to MDSS. These respondents might be more or less technically oriented with regard to software applications and surveillance than other medical personnel.

A specific limitation of the present T&E was related to the timely data input problems, which prevented complete evaluation of the system's critical feature, disease detection and alerting through DCD analysis. Since outlying clinics often did not enter data in near real-time, the PMOs did not trust the alert matrix reports and did not use this feature extensively. This was not an MDSS design flaw, but it did limit the T&E effort with regard to how the alert matrix might help medical personnel in real-time surveillance as a routine part of their jobs.

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Appendix A
MDSS User Training Survey

MDSS User Training Survey

Name: _____ Location: _____

Date: _____ Instructor: _____

What is your present position title (e.g., preventive medicine officer)? _____

What is the area of your training (e.g., epidemiology, statistics)? _____

1. User training provided me with an understanding of the purpose of MDSS.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable

Comments: _____

2. Now that the training has been completed, I understand how MDSS supports my job.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable

Comments: _____

3. I am prepared to use MDSS.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable

Comments: _____

4. There was sufficient time allocated for training on MDSS.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable

Comments: _____

5. I would recommend MDSS to my command.

☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree ☐ Not Applicable

Comments: _____

6. Please rate the usefulness of each of these MDSS capabilities on a scale of 1-5.

(1 = not at all useful; 2 = not useful; 3 = undecided; 4 = useful; 5 = very useful)

_____ MDSS Alert Matrix
_____ Trend Analysis Reports
_____ Medical Threat Assessment
_____ Patient Records Reports
_____ Data Analysis Capabilities
_____ "Drill-Down" or Investigation Capabilities
_____ Ad Hoc Reports
_____ Other (please specify) _____

7. Do you have any other observations or comments about the training or the MDSS software?

Appendix B
MDSS User Survey

MDSS User Survey

Please fill out this brief survey (10 – 15 minutes) as completely as you can. Return it in the addressed envelope provided. This work is sponsored by the Office of Naval Research and is being conducted by Naval Health Research Center to help improve the Medical Data Surveillance System (MDSS). Your responses will remain confidential and your privacy will be maintained throughout this research.

Questions can be directed to Ralph Burr, M.A., at:

Naval Health Research Center
P.O. Box 85122
San Diego, CA 92186-5122
619-553-7760

Your Name _____

Phone _____ E-mail address _____

Date _____

Background

Location of your present assignment:

____ Naval Medical Center, San Diego
____ Naval Hospital Camp Pendleton
____ Branch Medical Clinic Chinhae in Korea
____ U.S. Naval Hospital in Okinawa
____ Other _____

Gender: _____ Male _____ Female
Active Duty: _____ Yes _____ No

Service:

____ Navy
____ Army
____ Air Force
____ Marines

What is your present position title?

____ GMO (general medical officer)
____ PMO (preventive medicine officer)
____ EHO (environmental health officer)
____ IDC (independent duty corpsman)
____ Nurse
____ Physician's Assistant

____ Command surgeon
____ Task force surgeon
____ CINC surgeon
____ Epidemiologist
____ Task Force commander
____ HAZMAT
____ Other _____

Which area best describes your education and/or training (choose one)?

____ Statistics
____ Epidemiology
____ Preventive Medicine
____ Other _____

How often do you use the MDSS system presently deployed at your treatment facility?

____ I use it daily
____ I use it a few times a week
____ I use it a few times a month
____ I rarely use this system

Please describe how you used it. What features did you use in your job?

_____
_____
_____
_____

How much experience do you have with automated surveillance and medical data software other than MDSS? (months/years) _____

How much experience do you have working aboard a deployed ship? (months/years) _____

Your written comments will assist in the development of this technology for the medical support of the armed forces. Please provide comments wherever possible, even if they only include a few key words.

MDSS Information

1. The medical threat information provided through MDSS was useful.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

2. The medical threat information provided through MDSS was easy to use.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

3. The medical threat information provided through MDSS has the potential to be used for decision making.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

4. Medical threat information from MDSS was available fast enough to use in operational decision making.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

5. The medical threat information MDSS provided was presented in a useful format.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

_____

_____

_____

6. The quality of the medical threat information provided by MDSS is better than that provided by previous reporting methods. (Please specify reporting methods previously used.)

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

_____

_____

_____

7. I want MDSS in my next deployment.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

_____

_____

_____

8. The MDSS system was flexible enough to meet my needs. I could set it up to do what I wanted it to do efficiently.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

_____

_____

_____

9. The following is a list of MDSS component functions or programs that you may have used in the last few months. Please indicate your level of satisfaction. Please use the space below each item to comment why you rated each item the way you did.

a) Initial Threat Overview page/Alert Matrix

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

b) Disease and Non-Battle Injury (DNBI) reports

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

c) Dynamic Change-Point Detection (DCD) capabilities

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

d) Pivot tables

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

e) Epidemiological Tools/Drill-Down Investigation Capabilities

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

f) Population at Risk (PAR) Tables

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

g) Calendar function for reduced staff days

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

---

h) Graphs

☐ Very Satisfied ☐ Satisfied ☐ Undecided ☐ Dissatisfied ☐ Very Dissatisfied ☐ Not Observed

i) Other: _____

General Comments: _____

10. It was easy to navigate the MDSS system.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

11. MDSS helped me do my job.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ Not Observed

Please Explain: _____

12. The most useful thing about MDSS for my job was _____

13. The least useful thing about MDSS for my job was _____

14. If I could add one thing to MDSS, it would be _____

15. The introductory training provided by the product developers prepared me to use MDSS.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ I did not receive any formal training on this product

Please Explain: _____

_____

_____

_____

16. The CD I received after training containing the lessons and user guides helped me use MDSS.

☐ Strongly Agree ☐ Agree ☐ Neither Agree Nor Disagree ☐ Disagree ☐ Strongly Disagree
☐ I did not use the reference CD

Please Explain: _____

_____

_____

_____

Appendix C
MDSS Validation Task List

	Performed Successfully?		
Task			**Usability Issue/Comments**
User Role: Administrator			
Login as MDSS, password: MDSS			
Enter the Administrator Control Panel.			
View current database records.			
Grant user "Bohannan" administrative privileges.			
Create a new group named NHRC and grant access to all options.			
View population at risk (PAR).			
Modify Entity 2BN4MAR Longitude to 26.			
Add an entity to the PAR administration named "Null Unit B."			
Assign a reduced staff weekend for Null MTF.			

Task			**Usability Issue/Comments**
Log off MDSS			
User Role: Surveillance			
Log onto MDSS with username: NHRC and Password: NHRC			
View CBR Report, All MTFs, All Units, All visit types, weekly report, 2002-09-29 end date.			
View Weekly rate per thousand for Fever category.			
View Patient information for dates 2002-09-22 to 2002-09-29, full staff days.			
Generate a Dynamic Change-Point Detection Analysis for DNBI category: Respiratory, from 09-22 to 09-29, all visits, all units, all MTFs.			
Run a (Rate) Background Alert for MTF Tri-Care Outpatient San Diego 2, Major ICD9.			
Use the "drill-down" function to view the respiratory illnesses on high alert for 9/25/2002.			
Run a DNBI Report for all MTFs, All units, All visits, Monthly report for 2002-09-29 end date using calculated PAR values.			
View weekly incident rates for Respiratory category.			

Task	Y	N	Usability Issue/Comments
View DNBI Report: Monthly, category All Other, Medical/Surgical, all Units, all MTFs, Initial visits, 2002-09-29 end date.			
View Reportable Conditions Summary Report for all Units, all MTFs, Initial visits, Weekly report, and 09-29-2002 as the end date.			
Run Major ICD-9 Report for all Units, all MTFs, Initial visits, daily report and 09-29-2002 end date.			
Run 2x2 Contingency Table (Time Interval) for all Units, CBR category: "breathless, cough, sore throat, etc", for All Patients, Initial visits. Start/End dates 1: 2002-09-15, 2002-09-21			
Start/End dates 2: 2002-09-22, 2002-09-29			
Run Background Alert (Count) for MTF: NBMC NAS North Island, summary reportable conditions			
View "Occupational Exposure to Blood Borne Pathogens" graphs under the link with the same title.			
Access the Ill Defined Conditions category with alert status on MTF TriCare Outrpatient San Diego 2 on the Total Count Alert Matrix.			
View detail for Abdominal Pain in the Full Staff Days table.			
View patient information for 2002-09-22 to 2002-09-29.			

Task	Y	N	Usability Issue/Comments
Log off MDSS			
User Role: Non-medical			
Log onto MDSS with username: Bohannan and Password: bb			
Generate a Reportable Conditions Summary Report on all MTFs, all Military Units, follow-up visits, for end date 2002-09-29			
View Weekly Incidence for Occupational exposure to Blood Borne Pathogens.			
View Major ICD9 Report for MBNC Coronado, All Units, All Visits, 2002-09-29 end date, Weekly Report.			
View weekly Incidence - Ill Defined conditions.			
Log off			

REPORT DOCUMENTATION PAGE

1. Report Date (DD MM YY)	2. Report Type	3. DATES COVERED (from - to)
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Test and Evaluation of Medical Data Surveillance System at Navy and Marine Corps MTFS

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5b. Grant Number:
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6. AUTHORS Ted Melcer, Britt Bohannan, Ralph Burr, Tom Leap, Cheryl Reed, Bob Jeschonek

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Naval Health Research Center
P.O. Box 85122
San Diego, CA 92186-5122

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Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT (maximum 200 words)
Current military emphasis on disease surveillance makes it imperative to conduct rigorous testing and evaluation of maturing medical informatics technologies to enhance force protection. This research evaluated the Medical Data Surveillance System (MDSS), a Web-based automated surveillance tool intended to analyze medical information during extended naval deployment. This evaluation focused on MDSS's function and utility. Users were active-duty Military personnel working in preventive medicine or epidemiology; they were surveyed following MDSS training and again several months later after extended use. Controlled computer-based tests validated system functioning. The results indicated that MDSS functioned as intended under controlled conditions during validation tests and training. However, after extended use during deployment, users were unsure whether this version of MDSS helped them do their jobs. Users rated the product favorably, with specific suggestions to improve utility and ease of use. Users who worked on disease surveillance strongly favored the concept behind MDSS but did not believe it was ready to use routinely in their jobs. Further evaluation of the key disease-alerting capability of MDSS will be necessary due to data input problems. The consistent pattern of results seen across multiple data sources supports the scientific validity for measurement instruments used to evaluate this product.

15. SUBJECT TERMS
Test and Evaluation, Medical Informatics, Disease Surveillance, MDSS, Field Test

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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